GREENHECK
Building Value in Air.

Part #473501
ERCH-HP Energy Recovery Ventilator with Heat Pump

Installation, Operation and Maintenance Manual

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Model ERCH-HP

General Safety Information

Only qualified personnel should install this system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards, including environmental. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. All moving parts must be free to rotate without striking or rubbing any stationary objects.
3. Unit must be securely and adequately grounded.
4. Do not spin fan wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly affect motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Verify that the power source is compatible with the equipment.
6. Never open access doors to the unit while it is running.

DANGER

- Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch or breaker to prevent accidental power up.
- If this unit is equipped with optional gas accessories, turn off gas supply whenever power is disconnected.

CAUTION

This unit is equipped with a compressed refrigerant system. If a leak in the system should occur, immediately evacuate and ventilate the area. An EPA Certified Technician must be engaged to make repairs or corrections. Refrigerant leaks may also cause bodily harm.

CAUTION

When servicing the unit, the internal components may be hot enough to cause pain or injury. Allow time for cooling before servicing.

Receiving

Upon receiving the product, check to make sure all items are accounted for by referencing the bill of lading to ensure all items were received. Inspect each crate for shipping damage before accepting delivery. Notify the carrier if any damage is noticed. The carrier will make notification on the delivery receipt acknowledging any damage to the product. All damage should be noted on all the copies of the bill of lading which is countersigned by the delivering carrier. A Carrier Inspection Report should be filled out by the carrier upon arrival and filed with the Traffic Department. If damaged upon arrival, file claim with carrier. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Units are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Number and location of lifting brackets varies by model and size. Handle each piece in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of the unit to resist corrosion.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Inspection and Maintenance during Storage

While in storage, inspect units once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate all moving components by hand ten to fifteen revolutions to distribute lubricant on motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Units with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent.
For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

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Product Overview

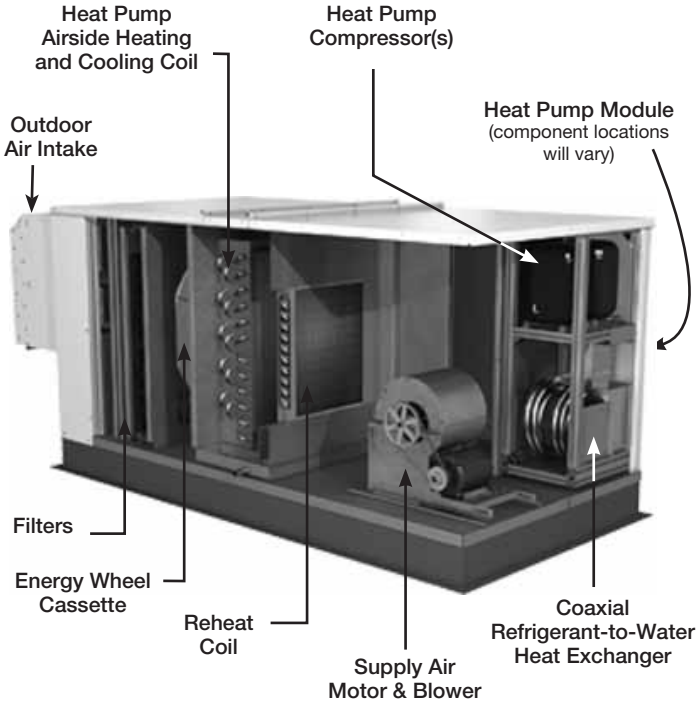
This unit brings in fresh, outdoor air and removes stale exhaust air from the building. The intake and exhaust airstreams move through the unit in opposite directions in separate passages, and each airstream passes through an energy wheel. In cooling mode, the energy wheel removes both heat and moisture from the incoming airstream and rejects it into the exhaust airstream. In heating mode, the energy wheel removes heat and humidity from the exhaust air and rejects it into the intake air, thus reclaiming energy already expended to heat the building air.

In addition to the energy wheel, this unit incorporates a packaged water source heat pump The heat pump system comes from the factory fully-charged with refrigerant and is ready for connection to a water source upon arrival.

For purposes of providing temporary emergency heat, an optional secondary heating source such as indirect gas furnace or electric heaters may also be installed.

The smaller tonnage units (4-6 tons) contain a single compressor, allowing for one stage of cooling. Larger units (8-30 tons) come standard with two compressors and a split airside coil. This allows for staging of compressors to meet a wider range of outdoor air loads while reducing the amount of cycles per compressor.

Simply put, this unit preconditions the outdoor air to save money on heating and cooling costs and then provides supplemental heating and cooling by means of a highly efficient heat pump.



Models and Capacities

This unit is manufactured in four different platform sizes; 20, 45, 55 and 90. Each platform has multiple options for heating and cooling capacities.

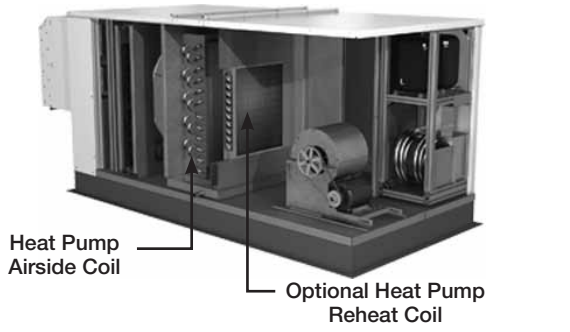
All 4, 5 and 6 ton capacity units have a single scroll type compressor and all other units have two scroll type compressors and use a split airside heat pump coil.

Heat Pump Capacity	
Unit Size	**Tons**
ERCH-HP 20	4, 5, 6
ERCH-HP 45	8, 10, 12.5, 15
ERCH-HP 55	15, 17.5, 20
ERCH-HP 90	20, 25, 30

Subassemblies

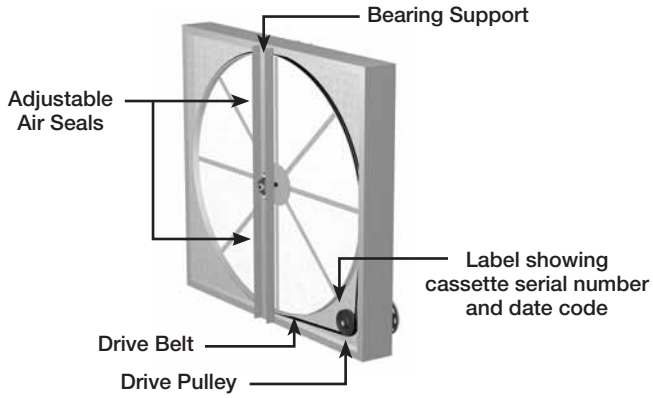
Coils

The airside coil is connected to the heat pump compressor(s) and is the primary vehicle for heating and cooling of the building. A reheat coil is optionally available and is installed in the supply airstream adjacent to the airside coil. The reheat coil is also connected to the heat pump but is used only when the unit is in cooling mode.



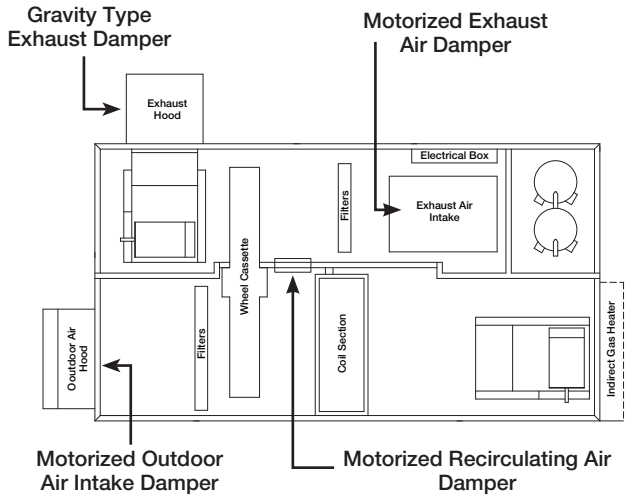
Energy Wheel

The energy wheel rotates through both the outdoor air and the exhaust airstreams, removing both sensible (heat) energy and latent moisture from one airstream and transferring it to the other airstream. The energy wheel itself is comprised of segments which can be removed for servicing.



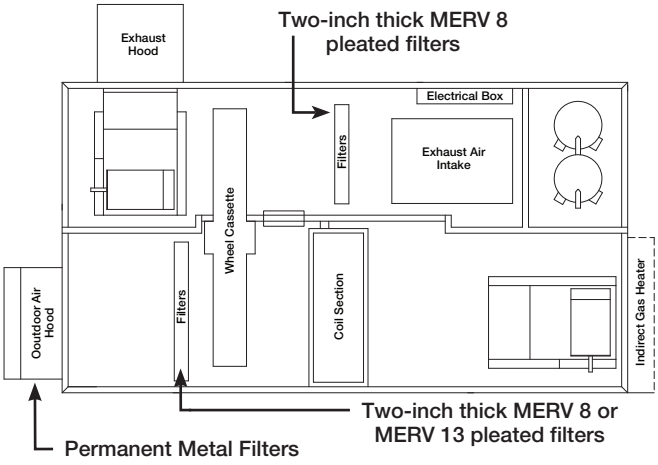
Dampers

There are four locations where dampers are optionally installed.



Filters

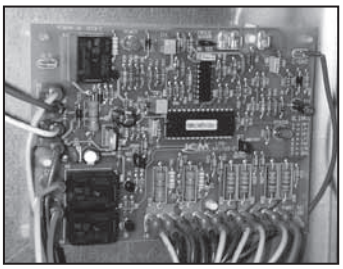
There are three locations in the unit where filters will be found.



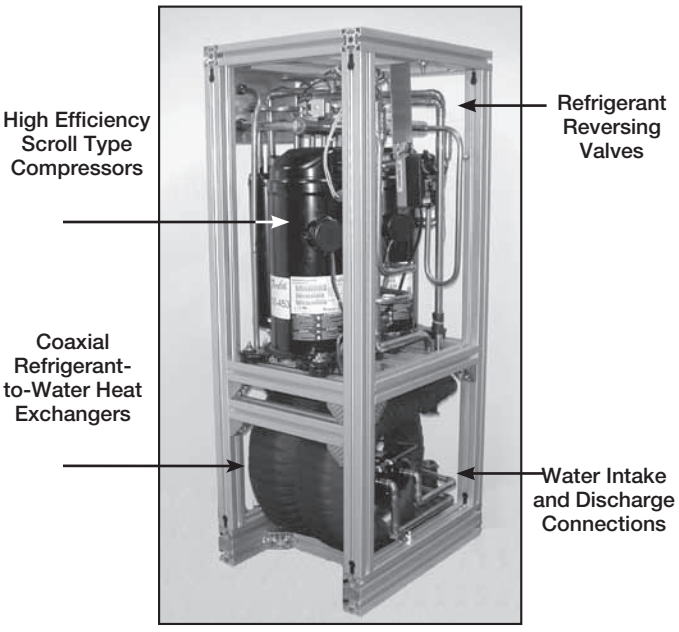
Heat Pump Module

Every unit has an integral heat pump module that contains hermetic scroll-type compressor(s), a coaxial refrigerant-to-water heat exchanger(s), refrigerant flow reversing valve(s), expansion valve(s), liquid line filter drier, high pressure manual reset cutout, crankcase heater(s) and various sensors, service ports and safety devices which allows the unit to run at less than full capacity and results in fewer compressor cycles. The heat pump is intended to be connected to an external water source such as a water cooling tower or boiler, a geothermal source or even a ground loop. The module is piped to the airside coil located in the intake airstream and optionally to a reheat coil that will control humidity. **The location of components in the module will vary**.

Control circuitry and the Unit Protection Module (UPM) for the heat pump module are located in the heat pump module. The UPM is a printed circuit board and has LED fault indicator lights to indicate various alarm conditions and also power status. A unit-specific schematic for electrical circuits is located in the control center and another unit-specific schematic for heat pump circuitry is located in the heat pump module.



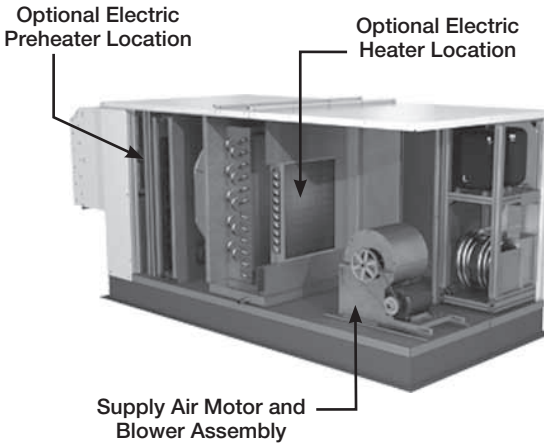
Unit Protection Module (UPM)



Heat Pump Module

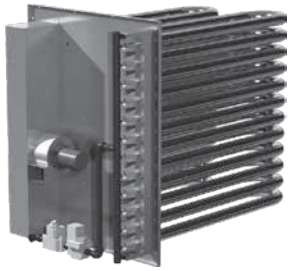
Optional Electric Heaters

There are two optional electric heaters available. One is a preheater and is used to prevent frost buildup on the energy wheel. It is located directly in front of the intake air filter assembly. The second optional heater is used as a supplementary emergency heat source for the building and is integrated into the supply airstream.



Optional Indirect Gas Furnace

An optional indirect gas furnace may be installed and provides supplementary emergency heat to the building. A complete Installation, Operation and Maintenance Manual for the furnace is provided with the unit. A unit-specific wiring diagram is located inside the furnace housing access door.



Indirect Gas Furnace

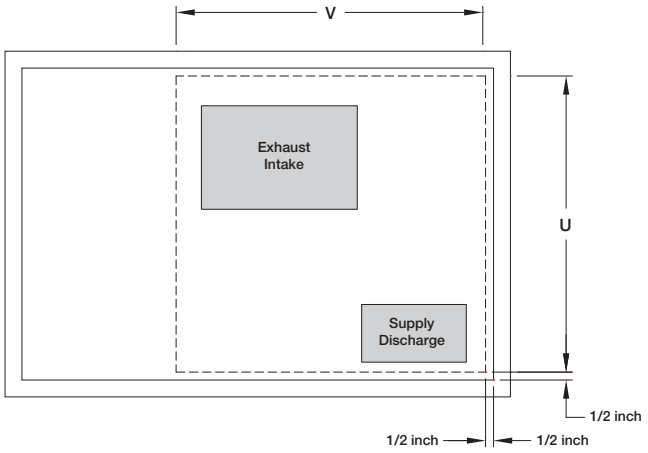
Installation

Dimensional Data

Model	Overall Exterior Dimensions		
	Width (including Lifting Lugs)	Overall Width (with Exhaust Hood)	Overall Length (with Outdoor Air Hood)
ERCH-HP 20	59.5	75	116
ERCH-HP 45	69.5	86	122
ERCH-HP 55	79.5	101	134
ERCH-HP 90	99.5	123	147

All dimensions shown are in inches.

Unit Weights and Recommended Roof Opening



Unit Size	U	V	Approximate Weight (pounds)
ERCH-HP 20	46	37	2150
ERCH-HP 45	54	39	3500
ERCH-HP 55	65	47	4450
ERCH-HP 90	85	49	5300

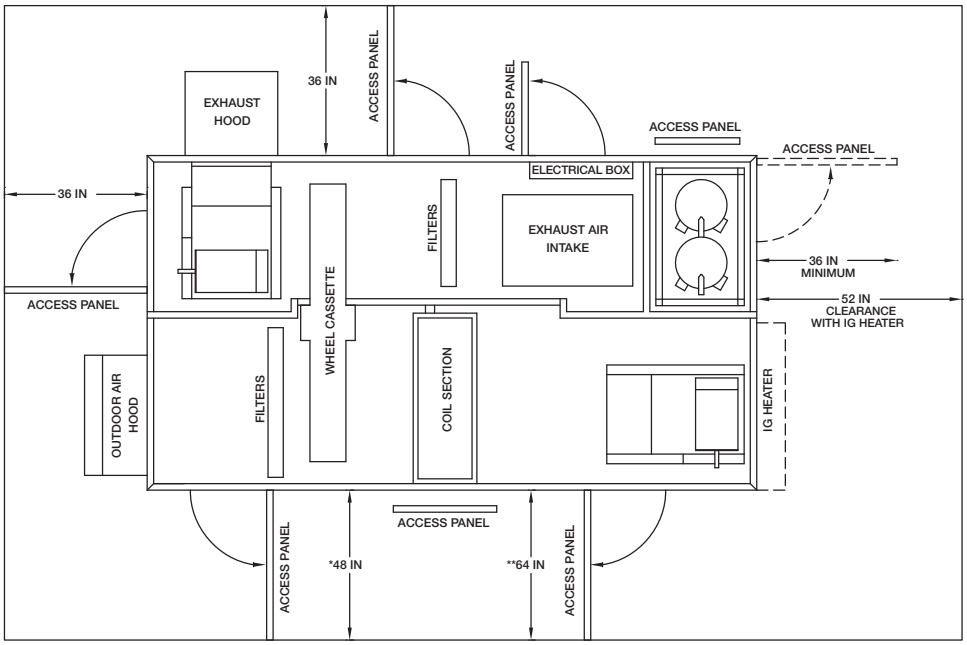
All dimensions are in inches. Unit weights assume rooftop configuration with weatherhoods, filters, outdoor air damper, six row DX coil, integral condensing section and an indirect gas-fired furnace.

Position the unit roof opening such that the supply discharge and exhaust inlet of the unit will line up with the corresponding ductwork. Be sure to allow for the recommended service clearances when positioning opening (see Service Clearances). Do not face the outdoor air intake of the unit into prevailing wind and keep the intake away from any other exhaust fans. Likewise, position the exhaust discharge opening away from outdoor air intakes of any other equipment.

Service Clearances

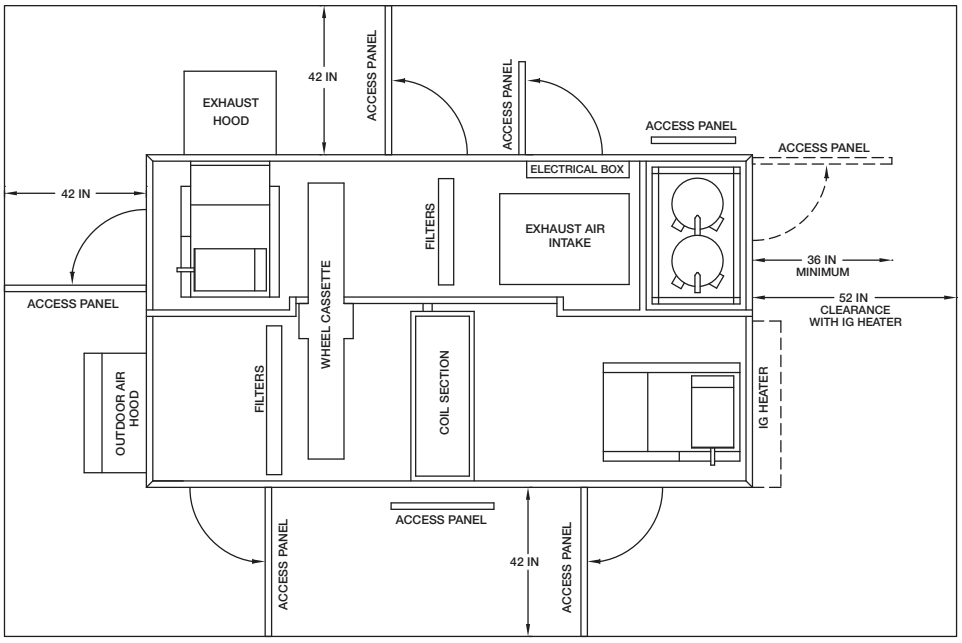
Minimum clearances are required for access on all sides for routine maintenance. Filter replacement, drain pan inspection and cleaning, energy wheel cassette inspection, fan bearing lubrication and belt adjustment are examples of routine maintenance that must be performed. Blower and motor assemblies, energy wheel cassette, coil and filter sections are always provided with a service door or panel for proper component access. Clearances for component removal may be greater than the service clearances, refer to drawings for these dimensions.

ERCH-HP 20
ERCH-HP 45



Clearances for service and component removal on ERCH-HP 20 and ERCH-HP 45
* Clearance for energy wheel removal on ERCH-HP 20
** Clearance for energy wheel removal on ERCH-HP 45

ERCH-HP 55
ERCH-HP 90



Clearances for service and component removal on ERCH-HP 55 and ERCH-HP 90

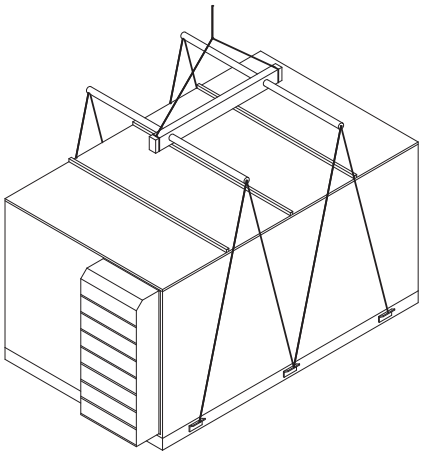
Handling

While this unit was constructed with quality and dependability in mind, damage still may occur during handling of the unit for installation. Exercise extreme caution to prevent any damage from occurring to the refrigerant system. This unit contains a system pressurized with refrigerant that, if damaged, could leak into the atmosphere or cause bodily harm due to the extreme cold nature of expanding refrigerant. Use protective equipment such as gloves and safety glasses to minimize or prevent injury in case of a system leak during installation.

The system design and installation should follow accepted industry practice, such as described in the ASHRAE Handbook. Adequate space should be left around the unit for piping coils and drains, filter replacement, and maintenance. Sufficient space should be provided on the side of the unit for routine service and component removal should that become necessary.

Lifting

1. Before lifting, be sure that all shipping material has been removed from unit.
2. To assist in determining rigging requirements, weights are provided in the Installation, Unit Weights and Recommended Roof Opening section of this manual.
3. Unit must be lifted by all lifting lugs provided on base structure.
4. Rigger to use suitable mating hardware to attach to unit lifting lugs.
5. Spreader bar(s) must span the unit to prevent damage to the cabinet by the lift cables.
6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift units by weatherhoods.
8. Never lift units in windy conditions.
9. Preparation of curb and roof openings should be completed prior to lifting unit to the roof.
10. Check to be sure that gasketing (supplied by others) has been applied to the curb prior to lifting the unit and setting on curb.
11. Do not use fork lifts for handling unit.



WARNING

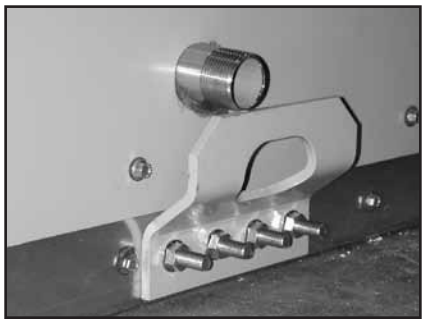
All factory provided lifting lugs must be used when lifting the units. Failure to comply with this safety precaution could result in property damage, serious injury, or death. Unit weights assume rooftop configuration with weatherhoods, filters, outdoor air damper, six row DX coil, integral condensing section and an indirect gas fired furnace.

Lifting Lugs

NOTE

On some models, one lifting lug may be positioned directly in front of the condensate drain connection.

Any lifting lug that is located as shown should be removed in order to permit installation of the P trap drain kit.



Roof Curb Mounting

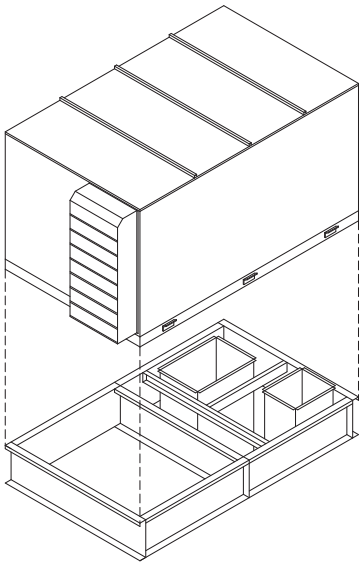
Rooftop units require curbs to be mounted first. The duct connections must be located so they will be clear of structural members of the building.

Factory Supplied Roof Curbs: Roof curbs are Model GKD, which are shipped in a knockdown kit (includes duct adapter) and require field assembly (by others). Assembly instructions are included with the curb.

Install Curb: Locate curb over roof opening and fasten in place. Reference Installation, Unit Weights and Recommended Roof Openings in this manual. Check that the diagonal dimensions are within ±1/8 inch of each other and adjust as necessary. For proper coil drainage and unit operation, it is important that the installation be level. Shim as required to level.

Install Ductwork: Installation of all ducts should be done in accordance with SMACNA and AMCA guidelines. Duct adapter provided to support ducts prior to setting the unit.

Set the Unit: Lift unit to a point directly above the curb and duct openings. Guide unit while lowering to align with duct openings. Roof curbs fit inside the unit base. Make sure the unit is properly seated on the curb and is level.

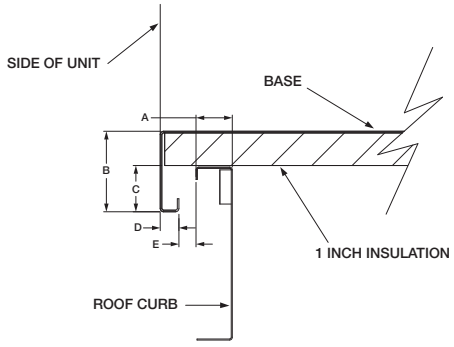


Set the Unit

Curb Outside Dimensions and Curb Weights (lbs)			
Unit Size	**L**	**W**	**Weight**
ERCH-HP 20	104.88	51.00	310
ERCH-HP 45	115.75	60.63	400
ERCH-HP 55	129.88	71.50	510
ERCH-HP 90	148.13	90.75	720

All dimensions are in inches. Weights are for 12 inch high curbs. Roof curb details, including duct locations dimensions are available on the roof curb assembly instructions.

Curb Outside Dimensions and Weights



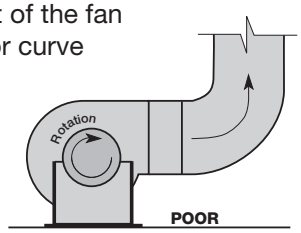
Curb Cap Details for Factory-Supplied Roof Curbs

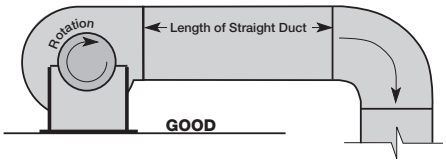
Curb Cap Dimensions					
Unit Size	**A**	**B**	**C**	**D**	**E**
ERCH-HP 20	2.00	2.00	1.00	0.88	0.75
ERCH-HP 45	2.00	4.25	2.00	1.31	0.50
ERCH-HP 55	2.00	4.25	2.00	1.31	0.50
ERCH-HP 90	2.00	4.25	2.00	1.31	0.50

All dimensions are in inches.

Ductwork Connections

Examples of poor and good fan-to-duct connections are shown below. Airflow out of the fan should be directed straight or curve the same direction as the fan wheel rotates. Poor duct installation will result in low airflow and other system effects.





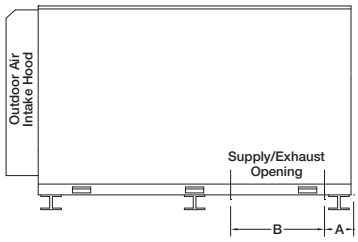
Recommended Discharge Duct Size and Length			
Unit Size	**Blower Size**	**Duct Size**	**Straight Duct Length**
ERCH-HP 20	9	14 x 14	36
ERCH-HP 45	10	20 x 20	36
ERCH-HP 55	12	20 x 20	36
ERCH-HP 90	15	28 x 28	60

All dimensions shown in inches.

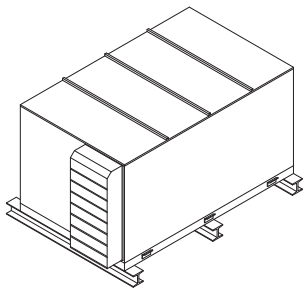
- Recommended duct sizes are based on velocities across the cfm range of each model at approximately 800 feet per minute (FPM) at minimum airflow and up to 1600 fpm at maximum airflow. Recommended duct sizes are only intended to be a guide and may not satisfy the requirements of the project. Refer to plans for appropriate job specific duct size and/or velocity limitations.
- Straight duct lengths were calculated based on 100% effective duct length requirements as prescribed in AMCA Publication 201. Calculated values have been rounded up to nearest foot.

Rail Mounting / Layout

- Rails designed to handle the weight of the unit should be positioned as shown on the diagram (rails by others).
- Make sure that rail positioning does not interfere with the supply air discharge opening or the exhaust air intake opening on the unit. Avoid area dimensioned “B” below.
- Rails should run the width of the unit and extend beyond the unit a minimum of 12 inches on each side.
- Set unit on rails.



Side view of unit on rails



Isometric view of unit

Rail Mounting		
Unit Size	**A**	**B**
ERCH-HP 20	5.0	41.0
ERCH-HP 45	7.0	41.9
ERCH-HP 55	5.5	53.0
ERCH-HP 90	6.0	59.0

All dimensions are in inches.

Exhaust Weatherhood

The exhaust weatherhood is shipped separately as a kit with its own instructions.

Start-Up Unit

DANGER

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

CAUTION

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

CAUTION

Do not operate without the filters and birdscreens installed. They prevent the entry of foreign objects such as leaves, birds, etc.

CAUTION

Do not run unit during construction phase. Damage to internal components may result and void warranty.

WARNING

- Unit was factory tested. All blowers, fans, and compressors are set-up to run correctly when supplied power. If any one fan is running backwards or the compressor is making loud noises, immediately turn off the power. Switch two leads on the incoming power to the disconnect. This will ensure proper operation of the unit. Failure to comply may damage the compressors and void the warranty.
- Do not jumper any safety devices when operating the unit. This may damage components within or cause serious injury or death.
- Do not operate compressor when the outdoor temperature is below 40ºF.
- Do not short-cycle the compressor. Allow 5 minutes between “on” cycles to prevent compressor damage.
- Prior to starting up the unit, power must be energized for 24 hours without a call for cooling to allow the compressor crankcase heaters time to boil off any liquid refrigerant present in the compressor.
- DX system is charged with refrigerant. Start-up must be performed by EPA Certified Technician.

Every installation requires a comprehensive start-up to ensure proper operation of the unit. As part of that process, the following checklist must be completed and information recorded. Starting up the unit in accordance with this checklist will not only ensure proper operation, but will also provide valuable information to personnel performing future maintenance. Should an issue arise which requires factory assistance, this completed document will allow unit experts to provide quicker resolve. Qualified personnel should perform start-up to ensure safe and proper practices are followed.

Unit Model No. _____

Unit Serial No. _____

Heat Pump Model No. _____

Energy Wheel Date Code _____

Compressor 1 Model No. _____

Compressor 2 Model No. _____

Start-Up Date _____

Start-Up Personnel Name _____

Start-Up Company _____

Phone Number _____

Pre-Start-Up Checklist

- ☐ Disconnect and lock-out all power switches.
- ☐ Remove any foreign objects that are located in the energy recovery unit.
- ☐ Check all fasteners, set-screws, and locking collars on the fans, bearings, drives, motor bases and accessories for tightness.
- ☐ Rotate the fan wheels and energy recovery wheels by hand and ensure no parts are rubbing.
- ☐ Check the fan belt drives for proper alignment and tension.
- ☐ Filters can load up with dirt during building construction. Replace any dirty pleated filters and clean the aluminum mesh filters in the intake hood.
- ☐ Verify that non-motorized dampers open and close properly.
- ☐ Check the tightness of all factory wiring connections.
- ☐ Verify control wire gauge.
- ☐ Verify diameter seal settings on the energy recovery wheel.
- ☐ Verify proper drain trap installation.
- ☐ Check condensing fans for any damage or misalignment. Spin the blades and make sure they don't contact any parts and are free turning without any resistance.
- ☐ Look over the piping system. Inspect for oil at all tubing connections. Oil typically highlights a leak in the system.
- ☐ Inspect all coils within the unit. Fins may get damaged in transit or during construction. Carefully straighten fins with a fin comb.
- ☐ If there is an indirect gas-fired furnace in this unit, refer to the maual provided with this unit for Pre-Start-Up information.
- ☐ This unit contains a crankcase heater for each compressor which needs power supplied to it 24 hours prior to start-up. If start-up is scheduled in 24 hours, unlock the disconnect power and energize unit.

SPECIAL TOOLS REQUIRED

- Voltage Meter (with wire probes)
- Amperage Meter
- Pressure Gauges – (refrigerant)
- Tachometer
- Thermometer
- Incline manometer or equivalent

Start-Up Procedure

The unit will be in operational mode during start-up. Use necessary precautions to avoid injury. All data must be collected while the unit is running. In order to measure volts and amps, the control center door must be open, and the unit energized using a crescent wrench to turn the disconnect handle.

- ☐ Make sure Pre-Start-Up checklist is complete.
- ☐ Jumper R to G, R to Y1, and R to Y2 (if applicable) on the control board.
- ☐ Turn the disconnect on. After 3 minutes compressors will come on. Make sure all fans and compressors are rotating the correct direction.
- ☐ Allow the unit to run until the refrigerant system stabilizes. Approximately 1-2 minutes.

Voltage Imbalance

In a 3-phase system, excessive voltage imbalance between phases will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2%. To determine voltage imbalance, use recorded voltage measurements in this formula.

Key: V1, V2, V3 = line voltages as measured
VA (average) = (V1 + V2 + V3) / 3
VD = Line voltage (V1, V2 or V3) that deviates farthest from average (VA)

Formula: % Voltage Imbalance = [100 x (VA-VD)] /VA

Unit Start-Up Checklist

Line Voltage. Check at unit disconnect.

L1-L2 _____ Volts L2-L3 _____ Volts L1-L3 _____ Volts

Motor Amp Draw

Supply Motor Amps	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps
Exhaust Motor Amps	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps

Fan RPM

Supply Fan RPM _____

Exhaust Fan RPM _____

Correct fan rotation direction?

Supply Fan Yes / No

Exhaust Fan Yes / No

Energy Wheel Motor

L1 _____ Amps L2 _____ Amps L3 _____ Amps

Compressors

Compressor 1	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps
Crankcase Heater	_____ Amps		
Compressor 2	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps
Crankcase Heater	_____ Amps		

Condensing Fans

Condensing Fan 1	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps
Condensing Fan 2	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps
Condensing Fan 3	L1 _____ Amps	L2 _____ Amps	L3 _____ Amps

Outdoor Air Temperature _____ Deg F

Return Air Temperature _____ Deg F

Outdoor Air Relative Humidity _____ % RH

Return Air Relative Humidity _____ % RH

Superheat _____ Deg F *Should be between 8° and 12°F*

Subcooling _____ Deg F *Should be between 12° and 17°F*

Discharge Pressure _____ PSIG *Should be between 200 and 280 PSIG for R22 or 300 and 500 PSIG for R410a*

Suction Line Pressure _____ PSIG *Should be between 60 and 80 PSIG for R22 or 100 and 135 PSIG for R410a*

Liquid Line Temp _____ Deg F

Suction Line Temp _____ Deg F

Moisture Indicating Sight Glass Liquid Visible? Yes / No Color of Center Dot: Green / Yellow

Hot Gas Bypass Operational Yes / No

Electrical Information

WARNING

The roof lining contains high voltage wiring. To prevent electrocution, do not puncture the interior or exterior panels of the roof.

WARNING

To prevent injury or death due to electrocution or contact with moving parts, lock disconnect switch open.

For units with a gas furnace, if you turn off the power supply, turn off the gas.

IMPORTANT

Before connecting power to the unit, read and understand the following instructions and wiring diagrams. Complete wiring diagrams are attached on the inside of the control center door(s).

IMPORTANT

All wiring should be done in accordance with the latest edition of the National Electric Code ANSI/NFPA 70 and any local codes that may apply. In Canada, wiring should be done in accordance with the Canadian Electrical Code.

IMPORTANT

The equipment must be properly grounded. Any wiring running through the unit in the airstream must be protected by metal conduit, metal clad cable or raceways.

CAUTION

If replacement wire is required, it must have a temperature rating of at least 105ºC, except for an energy cut-off or sensor lead wire which must be rated to 150ºC.

DANGER

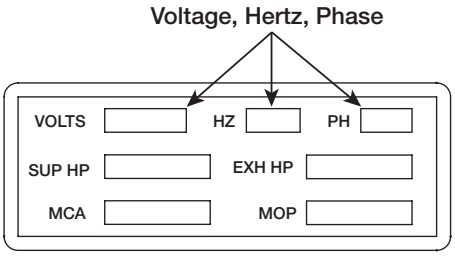
High voltage electrical input is needed for this equipment. This work should be performed by a qualified electrician.

CAUTION

Any wiring deviations may result in personal injury or property damage. Manufacturer is not responsible for any damage to or failure of the unit caused by incorrect final wiring.

Determine the Size of the Main Power Lines

The unit's nameplate states the voltage and the unit's MCA. The main power lines to the unit should be sized accordingly. The nameplate is located on the outside of the unit on the control panel side.



Electrical Nameplate

Determine the Size of Electric Heater Wiring

An optional electric heater may require a separate power supply. The power connection should be made to the factory-provided electric heater disconnect and must be compatible with the ratings on the nameplate, supply power voltage, phase and amperage. Consult ANSI/NFPA 70 and CSA C22.1 for proper conductor sizing.

Provide the Opening(s) for the Electrical Connections

Electrical openings vary by unit size and arrangement and are field-supplied.

Connect the Power Supplies

Connect the main power lines and electric heater power lines to the disconnect switches or terminal blocks and main grounding lug(s). Torque field connections to manufacturer's recommendations.

Wire the Optional Convenience Outlet

The convenience outlet requires a separate 115V power supply circuit. The circuit must include short circuit protection which may need to be supplied by others.

Connect Field-Wired Low Voltage Components

Reference the Ladder Diagram on the inside of the control center door for correct wiring of the following accessories:

- Remote Panel
- Room Temperature Sensor
- Room Dehumidistat
- Discharge Temperature Sensor

Most factory-supplied electrical components are prewired. To determine what electrical accessories require additional field-wiring, refer to the unit-specific wiring diagram located on the inside of the control center access door.

The low voltage control circuit is 24 VAC and control wiring should not exceed 0.75 ohms.

Control wires should not be run inside the same conduit as that carrying the supply power. Make sure that field-supplied conduit does not interfere with access panel operation. All low voltage wiring should be run in conduit wherever it may be exposed to the weather.

If wire resistance exceeds 0.75 ohms, an insulator relay should be added to the unit control center and wired in place of the remote switch (typically between terminal blocks R and G on the terminal strip. The relay must be rated for at least 5 amps and have a 24 VAC coil. Failure to comply with these guidelines may cause motor starters to “chatter” or not pull in which can cause contactor failures and/or motor failures.

Discharge Air Temperature Sensor

WARNING

Discharge air temperature sensor is to be field-installed prior to unit start-up.

The sensor is to be installed at least three duct diameters downstream of the heat exchangers or where good mixed average temperature occurs. All other sensor and low voltage devices are connected to the low voltage terminal strip in the control center. This discharge air sensor is shipped loose and can be found in the unit’s control center. See the unit-specific wiring diagram for connection locations.

Plumbing / Piping Overview

Condensate Drain Trap

This unit is equipped with a stainless steel condensate pan with a stainless steel connection. It is important that the drain connection be fitted with a P trap to ensure proper drainage of condensate while maintaining internal static pressures.

A P trap assembly (kit) is supplied with each unit and is to be assembled and installed as local conditions require and according to the assembly instructions provided with the P trap. If local and area codes permit, the condensate may be drained back onto the roof, but a drip pad should be provided beneath the outlet. If local and area codes require a permanent drain line, it should be fabricated and installed in accordance with Best Practices and all codes. In some climates, it will be necessary to provide freeze protection for the P trap and drain line. The P trap should be kept filled with water or glycol solution at all times and it should be protected from freezing to protect the P trap from damage. If severe weather conditions occur, it may be necessary to fabricate a P trap and drain line of metal and install a heat tape to prevent freezing.

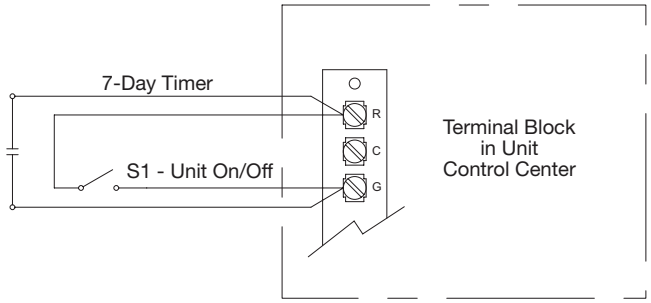
Optional Remote Control Panel and Wiring Schematics

The remote panel is a series of junction boxes ganged together and includes a stainless steel faceplate. The remote panel is available with a number of different alarm lights and switches to control the unit. The remote panel ships loose and requires mounting and wiring in the field

The remote panel is available with the following options:

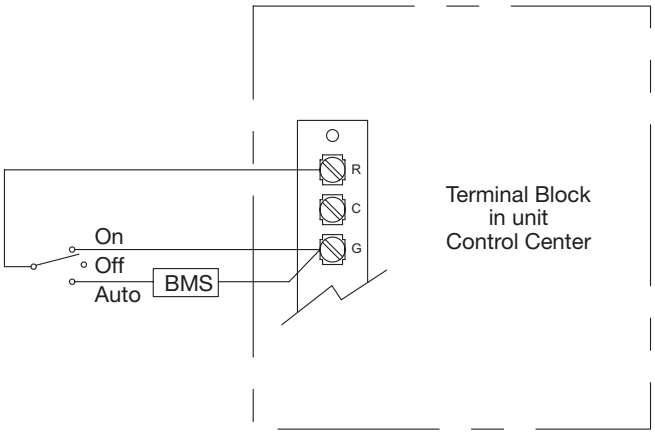
- Unit on/off switch
- Unit on/off light
- 7-day time clock
- Hand/off/auto switch
- Dirty filter light
- Economizer light
- Frost control light
- Wheel rotation sensor light

7-Day Timer or On/Off Switch



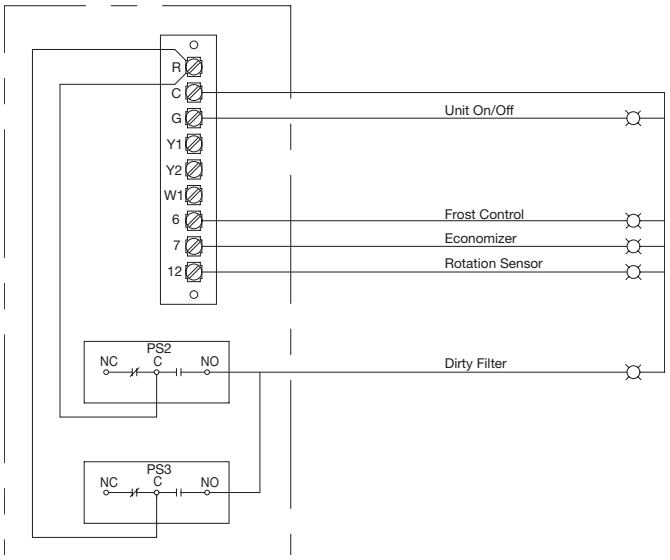
For 7-Day Timer, use blue and black wires.
Red wires should be capped off.

Hand/Off/Auto Switch

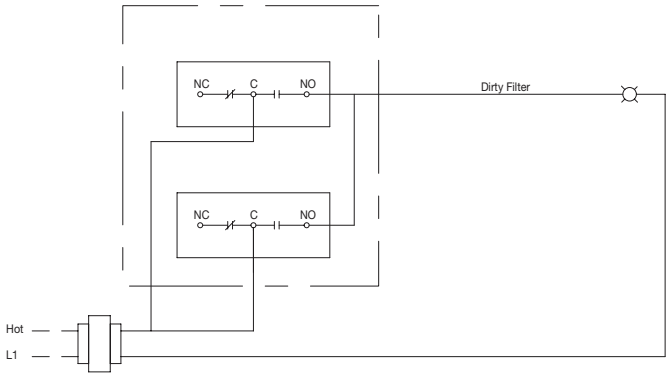


Hand/Off/Auto Switch allows the unit to
"Off" - off
"On" - Manual Operation
"Auto" - Unit is controlled by BMS, RTU, etc.
NOTE: RTU controllers are by others.

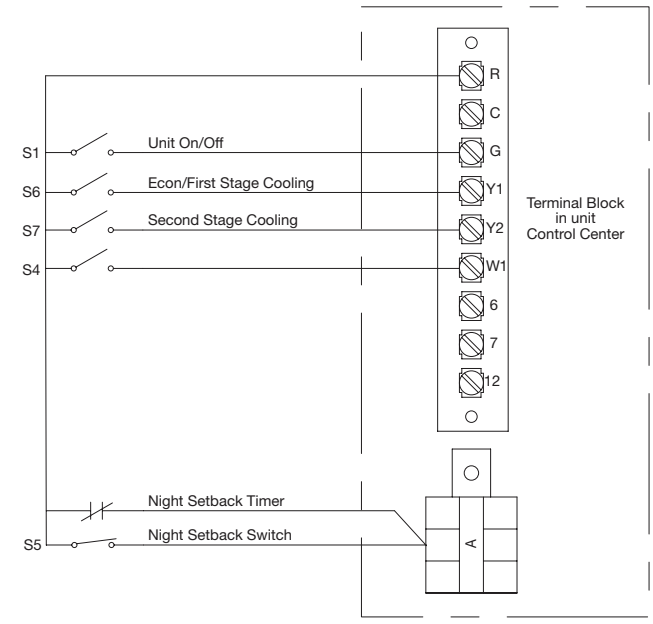
Indicator Lights powered by the ER Unit



Dirty Filter Indicator *(power by others)*



Heating/Cooling Switches and Night Setback Switch/Timer

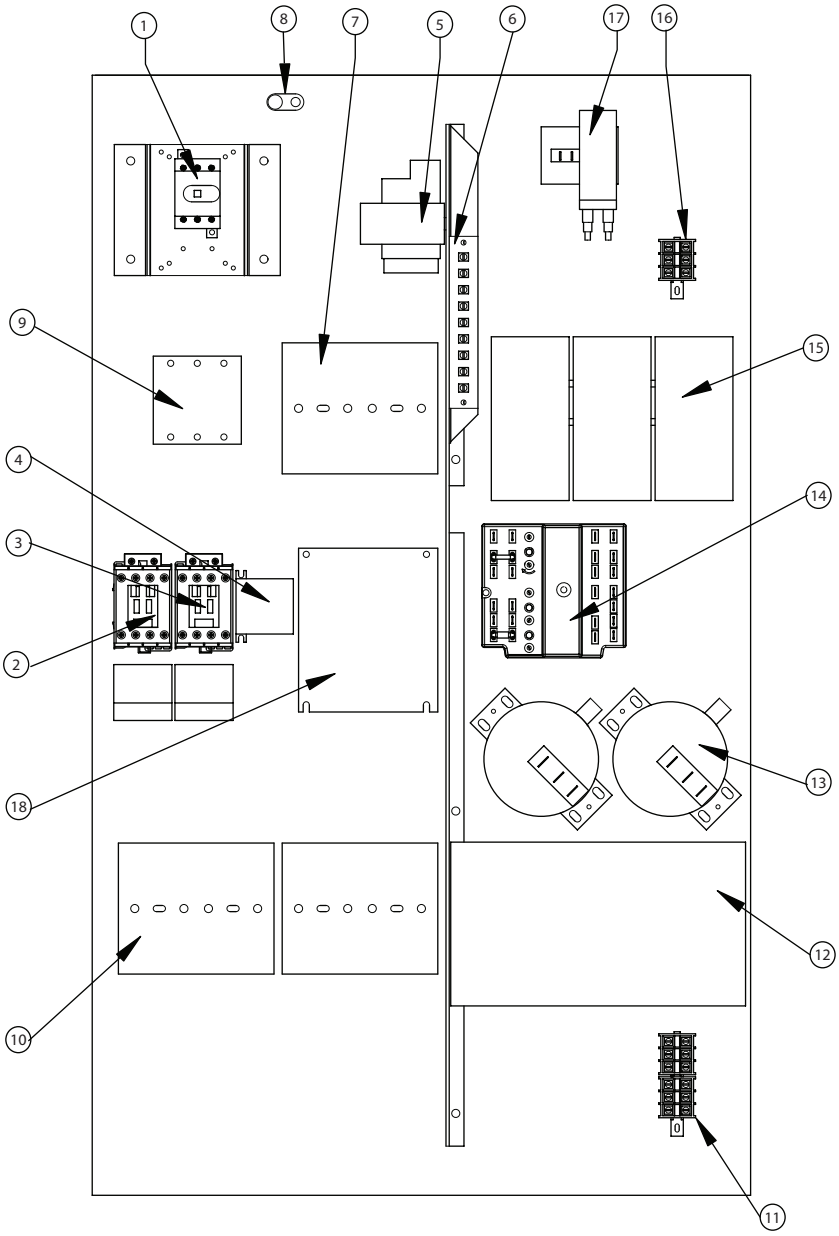


Typical Control Center Components - individual components and locations will vary

1. Main disconnect (non-fusible, lockable)
2. Motor starter - exhaust air fan
3. Motor starter - outdoor air fan
4. Motor contactor - energy wheel
5. 24 VAC control transformer
6. 24 VAC terminal strip
7. Fuses for blower motors
8. Grounding lug
9. Distributor block
10. Compressor fuse blocks
11. Terminal block

Optional Control Center Components

12. DDC controller
13. Dirty filter pressure switches
14. Economizer module
15. Thermostats for:
    - Economizer module
    - Energy recovery wheel frost control
16. Terminal block
17. Frost control pressure switch
18. Energy recovery wheel VFD



Component #6
Detail of Terminal Strip

Refer to “Heat Pump System” section for components in compressor compartment

Electrical Controls

Optional Frost Control

Extremely cold outdoor air temperatures can cause moisture condensation and frosting on the enthalpy wheel. Frost control is an optional feature that will prevent/control wheel frosting. Three options are available:

1. Timed Exhaust frost control
2. Electric preheat frost control
3. Modulating wheel frost control

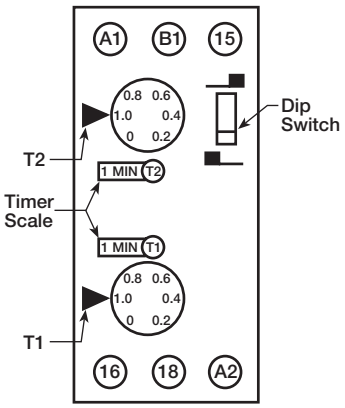
All of these options are provided with a thermostat (with probe) mounted in the outdoor air intake compartment and a pressure sensor to monitor pressure drop across the enthalpy wheel. The typical temperature setting corresponds to the indoor air relative humidity as shown in the Frost Threshold Temperatures table and represents when frost can occur. An increase in pressure drop would indicate that frost is occurring. Both the pressure sensor and the outdoor air temperature sensor must trigger in order to initiate frost control. The two sensors together ensure that frost control is only initiated during a real frost condition. Field wiring of a light (or other alarm) between 6 and C in the control center will notify personnel when unit is in frost control mode.The following explains the three options in more detail.

Frost Threshold Temperatures	
Indoor RH at 70°F	**Frost Threshold Temperature**
20%	-10° F
30%	-5° F
40%	0° F

Timed exhaust frost control includes a timer in addition to the thermostat and wheel pressure sensor. When timed exhaust frost control is initiated, the timer will turn the supply blower on and off to allow the warm exhaust air to defrost the enthalpy wheel. Default factory settings are 5 minutes off and 30 minutes on. Use the following test procedure for troubleshooting.

Testing (refer to Timer diagram)

- Jumper the wheel pressure switch in the unit control center. Set the Timer Scale for T1 and T2 to 1 minute. Set the Timer Settings for T1 and T2 to 1.0. Set the dip switch to the down position. (normal position)



Timer

- Turn the temperature sensor up as high as possible. The supply blower should cycle on for one minute, then turn off for one minute.
- After testing, set the ***Timer Scale*** as follows: T1 = 10 minutes, T2 = 1 hour
- Set the **Timer Settings** as follows: T1 = 0.5, T2 = 0.5. The timer is now set for 5 minutes off and 30 minutes on. ***Remember to remove the jumper.***

Electric preheat frost control includes an electric heater (at outdoor air intake) and an airflow pressure switch (located at the preheater) in addition to the thermostat and pressure sensor on wheel. When electric preheat frost control is initiated, the electric preheater will turn on and warm the air entering the energy wheel to avoid frosting. Use the following test procedure for troubleshooting.

Testing

- If no DDC controller is present, jumper thermodisc and jumper the wheel pressure sensor. The heater should turn on.
- If it doesn't, either put the outdoor airside doors on or temporarily jumper the airflow pressure switch in the preheater control center to avoid nuisance tripping of the pressure switch. Also check the airflow switch pressure tap located at the supply discharge blower to ensure the tubing is connected and the tap is not blocked. ***Remember to remove the jumpers.***

Modulating wheel frost control includes a variable frequency drive in addition to the thermostat and pressure sensor. When modulating wheel frost control is initiated, the variable frequency drive will reduce the speed of the wheel. Reducing the speed of the energy wheel reduces its effectiveness, which keeps the exhaust air condition from reaching saturation, thus, eliminating condensation and frosting. If the outdoor air temperature is greater than the frost threshold temperature OR the pressure differential is less than the set point, the wheel will run at full speed. If the outdoor air temperature is less than the frost threshold temperature AND the pressure differential is greater than the set point, the wheel will run at reduced speed until the pressure differential falls below the set point. The temperature and pressure differential set points are set at the factory, but are field-adjustable. The variable frequency drive will be fully programmed at the factory.

Optional Economizer

The energy wheel operation can be altered to take advantage of economizer operation (free cooling). Two modes are available:

1. De-energizing the wheel.
2. Modulating the wheel.

A field-supplied call for cool (Y1) is required. De-energizing the wheel is accomplished with a signal from a temperature or enthalpy sensor mounted in the air intake compartment. This primary sensor will de-energize the energy wheel when the outdoor air temperature (factory default is 65ºF) or enthalpy (factory default is the 'D' setting) is below the field adjustable set point. An override temperature sensor is also furnished in the outdoor air intake compartment to deactivate economizer mode. The override (with field adjustable set point) is set at some temperature lower than the primary sensor (factory default is 50ºF). Effectively, the two sensors create a deadband where the energy recovery wheel will not operate and free cooling from outside can be brought into the building unconditioned.

Testing

Temperature Sensor with Override

- Turn both temperature and override thermostats down as low as they go. The wheel should be rotating.
- Turn the temperature sensor up as high as it goes, and keep the override sensor as low as it will go. The wheel should stop rotating.
- Turn both sensors as high as they will go. The wheel should start rotating.
- Set the temperature sensor at desired point for economizer operation to begin. Set the override sensor at desired point for economizer operation to end (factory default is 65ºF and 50ºF, respectively).

Enthalpy Sensor with Override

- Turn unit power off. Disconnect C7400 solid state enthalpy sensor from terminal So on the enthalpy controller. Also, disconnect the 620 ohm resistor from terminal Sr on the enthalpy controller. Turn unit power on. The LED on the enthalpy controller should light and the energy recovery wheel should not rotate.
- Turn unit power off. Reconnect 620 ohm resistor to terminal Sr on the enthalpy controller. Turn unit power on. The LED on the enthalpy controller should not light and the energy recovery wheel should energize and rotate.

Enthalpy Controller

If the steps above provide the results described, the enthalpy economizer is working properly.

- Turn unit power off. Reconnect C7400 solid state enthalpy sensor to terminal So.

Modulating the wheel: In applications in which an internal heat gain is present in the space, the rotational speed of the energy wheel may be modulated (via variable frequency drive) to avoid overheating the space during the winter. The speed of the energy wheel will be controlled in response to the discharge temperature set point.

Sequence of operation: The variable frequency drive is fully programmed at the factory. A "call for cool" must be field wired to the unit (terminals provided in unit - refer to wiring diagram in unit control center) to allow for initiation of economizer mode. When the space calls for cooling, factory supplied controls will drive the following wheel operations:

Where (T_{OA}) is the outdoor air temperature set point, (T_{RA}) is the return air temperature set point, and (T_{SA}) is the supply air discharge thermostat set point.

$T_{AO} > T_{RA}$	Wheel runs at full speed. (maximum energy recovery)
$T_{AO} < T_{RA}$ and $T_{AO} > T_{SA}$	Wheel is stopped. (no energy recovery)
$T_{AO} < T_{RA}$ and $T_{AO} < T_{SA}$	Wheel will modulate to maintain discharge temperature.

Phase Monitor

The unit control circuitry includes a phase monitor that constantly checks for phase reversal, loss of phase or a power brownout. It requires 24 VAC to operate and when it detects a fault, it cuts off the 24 VAC that goes to the low voltage terminal strip, thereby shutting off all motors.

Typical Phase Monitor

Variable Frequency Drive (VFD)

If a VFD was provided and installed at the factory, it has been preset to control the speed of the blower motor for optimum performance. The motor speed needs to be verified during test and balance of the unit.

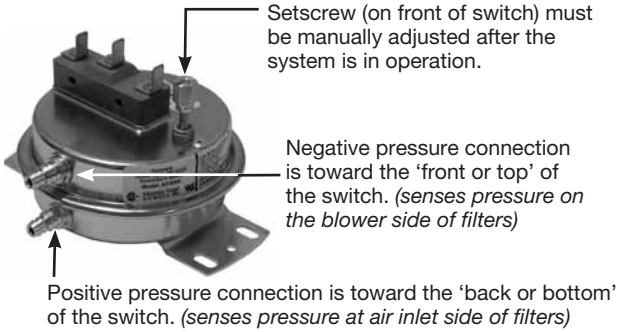
Typical Variable Frequency Drive (VFD)
Refer to unit-specific documentation.

Optional Rotation Sensor

The rotation sensor monitors energy wheel rotation. If the wheel should stop rotating, the sensor will close a set of contacts in the unit control center. Field-wiring of a light (or other alarm) between terminals R and 12 in the unit control center will notify maintenance personnel when a failure has occurred.

Dirty Filter Sensor

Dirty filter sensors monitor pressure drop across the outdoor air filters, exhaust air filters, or both. If the pressure drop across the filters exceeds the set point, the sensor will close a set of contacts in the unit control center. Field-wiring of a light (or other alarm) to these contacts will notify maintenance personnel when filters need to be replaced. The switch has not been set at the factory due to external system losses that will affect the switch. This switch will need minor field adjustments after the unit has been installed with all ductwork complete. The dirty filter switch is mounted in the exhaust inlet compartment next to the unit control center or in unit control center.

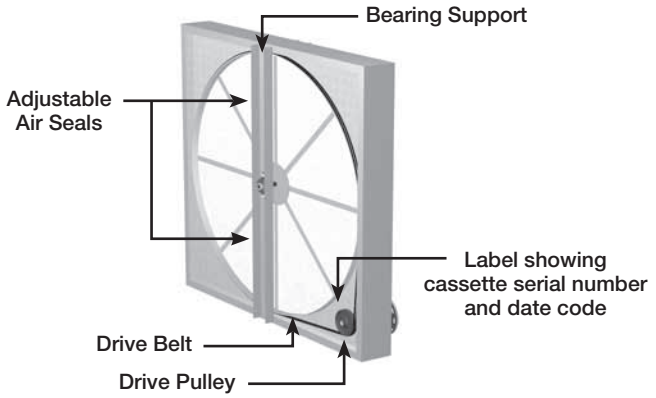


To adjust the switch, the unit must be running with all of the access doors in place, except for the compartment where the switch is located (exhaust intake compartment). The adjusting screw is located on the top of the switch. Open the filter compartment and place a sheet of plastic or cardboard over 50% of the filter media. Replace the filter compartment door. Check to see if there is power at the alert signal leads. Whether there is power or not, turn the adjustment screw on the dirty filter gauge (clockwise if you did not have power, counterclockwise if you did have power) until the power comes on or just before the power goes off. Open the filter compartment and remove the obstructing material. Replace the door and check to make sure that you do not have power at the alert signal leads. The unit is now ready for operation.

Energy Wheel

Start-Up

If selected, the energy wheel is installed in the unit's airstream with one half of the wheel in the intake airstream and one half in the exhaust airstream. Air leakage between the two airstreams has to be kept to a minimum and the wheel has air seals that must be adjusted for that purpose. The seals must be adjusted at time of start-up. The wheel can be accessed through the door labeled Energy Wheel Access.



Drive Belt

Inspect the drive belt. Make sure the belt rides smoothly in the pulley and around the outside of the wheel. Note the directional arrow and data information shown in the image.

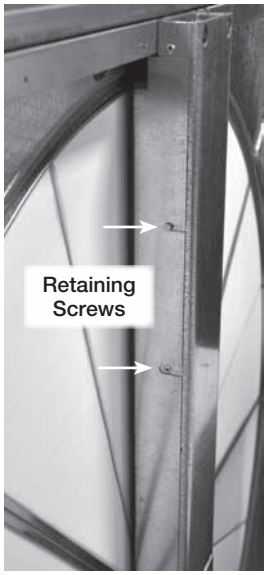
Motor Pulley and Belt

Adjust the Air Seals

The first step in wheel seal adjustment is to make sure the unit power supply is locked out. Disconnect the wiring to the wheel module and pull the wheel cassette out of the cabinet on its tracks. Large cassettes are not removable. Then slowly rotate the wheel by hand to make sure there is no binding or misalignment. The wheel should rotate smoothly and should not bind.

There is a perimeter seal located around the outside of the wheel and a diameter seal across the face of the wheel on both sides. Check to make sure that all air seals are secure and in good condition.

Adjust the air seals by loosening all the air seal retaining screws on the bearing support (see image for reference). Using a piece of paper as a feeler gauge, adjust the seals so they almost touch the face of the wheel while tugging slightly on the paper. When the wheel is rotated, there should be a slight tug on the paper. Tighten the screws, repeat the steps on the other set of seals.



Bearing Support Bar
showing air seal assembly

Push the wheel cassette back into the unit and plug in the power connector. Turn the main power supply back on and then observe the operation of the wheel by opening the wheel access door slightly. Remove filters if necessary to observe the wheel.

Sequence of Operation

Optional Economizer - The economizer will be locked out when: the outside air is <40°F (- 2°F hysteresis, adjustable); the unit is operating in dehumidification mode; or there is a call for heating.

- **Stop Wheel:** When economizer mode is enabled and there is a signal for cooling, the wheel will stop rotating to allow free cooling.
- **Modulate Wheel:** When economizer mode is enabled and there is a signal for cooling, the wheel VFD modulates wheel speed to maintain the discharge temperature set point.

Optional Frost Control - The DDC controller will output a signal when wheel frosting is occurring which is determined by a temperature set point (OA <5°F – 2°F hysterisis, adjustable) and wheel pressure drop increase.

- **Preheat:** When frosting is occurring, the preheater is energized to defrost the wheel. Once the pressure drop decreases below the set point, the preheater is de-energized.
- **Timed Exhaust:** When frosting is occurring, the supply blower is cycled off. The exhaust blower shall continue to run, allowing the warm exhaust air to defrost the wheel. After the 10 minute cycle, the supply fan are re-energized to continue normal operation.

Alarms Indication - DDC shall have one digital output for remote indication of an alarm condition.

- **Wheel Rotation Alarm:** Monitors wheel rotation, and sends a signal to controller (after a 15 second time delay with no rotation) that signals the DDC to activate an alarm.

Energy Wheel Maintenance

WARNING

Whenever performing maintenance or inspections, always disconnect the power source.

Inspection

The wheel should be inspected semiannually in accordance with the maintenance schedule. Maintenance of the wheel consists mainly of inspecting the wheel for cleanliness and then checking the drive motor, belt, and pulley for wear. If the wheel layers appear dirty, the wheel should be disassembled and cleaned.

Energy Wheel Cassette

The wheel rotates through the two airstreams which are moving in opposite directions, the wheel is self-cleaning, up to a point. If the wheel media becomes blocked by dirt or dust, or if the media collects a layer of smoke residue or an oily film, the energy transfer efficiency drops.

The main factor in the frequency of cleaning is the cleanliness of the air. If air filters are not changed frequently, the wheel will collect contaminants and will then have to be cleaned.

Wheel Disassembly

Wheels are part of a cassette that may be pulled from the unit for easy access. There may be a small damper assembly or other component that blocks removal of the cassette. Before sliding out the cassette or any other component, disconnect any power supply cord and secure it so it cannot jam or otherwise get damaged.

Each wheel has removable segments that hold the coated layers of media and each segment is held in place with two retaining clips located on the outer rim of the wheel. When removing more than one segment, remove them in sequence from opposite sides of the wheel (180 degrees apart) to reduce the imbalance. Secure the wheel against rotation. Carefully release the two retaining clips and swing them fully open. The segment can now be removed by pushing the face of the segment close to the outer rim of the wheel. Wheel segments are built to close tolerances and the segment may have to be jiggled to remove it. Do not use a hammer or otherwise force the segment because these are high value items and are not built to withstand abuse.

Segment Retaining Clip

Whenever retaining clips are opened, they should be closed as soon as possible. If the wheel should rotate when a clip is open, the clip will jam against the bearing support bar and could cause damage.

Cleaning

Maintenance or cleaning of the wheel segments should be done with the segments removed from the wheel cassette to avoid splashing liquids or cleaning agents inside the cabinet. If the energy wheel appears excessively dirty, it should be cleaned to ensure maximum operating efficiency. Only excessive buildup of foreign materials needs to be removed. **DISCOLORATION AND STAINING OF ENERGY RECOVERY WHEEL DOES NOT AFFECT ITS PERFORMANCE.**

Thoroughly spray the wheel matrix with a household cleaner such as Fantastik™ or the equivalent. Gently rinse with warm water and use a soft brush to remove any heavy accumulations. A detergent/water solution can also be used. Avoid aggressive organic solvents, such as acetone. Wheel segments can be soaked in the above solution overnight for removal of stubborn dirt or accumulations.

After cleaning is complete, shake excess water from the wheel or segments. Dry the wheel or segments before putting them back into the cassette.

Reassembly

When reinstalling the segments, be sure to install them with the correct face toward the motor side of the cassette. Note that one face of each segment is smooth and the other face has a reinforcing channel or support cut into the surface.

Wheel Segment (Pulley Side)

Wheel Segment (Motor Side)

Energy Recovery Wheel Belt

Inspect belts each time filters are replaced. Belts that look chewed up or are leaving belt dust near the motor pulley may indicate a problem with the wheel. Be sure to inspect wheel for smooth and unrestricted rotation. If a belt requires replacement, contact the local Greenheck representative. Instructions for replacement will ship with the new belt.

Energy Recovery Wheel Bearing

In the unlikely event that a wheel bearing fails, the bearing is behind a removable plate on the wheel support beam (slide cassette halfway out of cabinet to access). Contact the local Greenheck representative for detailed instructions on how to replace the bearing.

Energy Wheel Troubleshooting

Symptom	Possible Cause	Corrective Action
Energy wheel does NOT turn	Air seals are too tight.	See air seals under Start-Up, Energy Wheel section.
	Broken belt.	Replace.
	No power to wheel motor.	Make sure wheel drive is plugged in. Verify power is available.
Energy wheel runs intermittently	Wheel motor overloads are tripping due to rubbing between wheel and air seals.	Recheck air seals, make sure they are not too tight. See Adjust the Air Seals under Start-Up, Energy Wheel section.

Heat Pump Overview

Every unit has a complete, sealed refrigeration system that is ready for connection to a water source.

The heat pump has all the typical DX components and also has refrigerant reversing valve(s) to enable the system to work in both heating and cooling modes.

Factory-Installed Heat Pump System Components:

Thermostatic Expansion Valve (TXV)
Each compressor is equipped with a thermal expansion valve. The valve controls the flow of liquid refrigerant entering the evaporator coil by maintaining a constant, factory set superheat of 10ºF.

Refrigerant Distributor
Attached to the TXV is a refrigerant distributor. The refrigerant distributor evenly distributes the refrigerant to each circuit of the airside coil to provide optimum performance.

Airside Coil
Each unit uses a single refrigerant coil known as an airside coil. If two compressors are used in the unit, then the airside coil will be a split configuration so that each compressor has a dedicated portion of the airside coil. Depending on whether the unit is in cooling or heating mode, the airside coil will function as either a condensing coil or an evaporator coil. See also Subassemblies/Coils.

Coaxial Refrigerant-to-Water Heat Exchanger
The unit uses one coaxial heat exchanger per compressor, essentially a tube inside a tube. Water flows through the inner copper tube and compressed refrigerant is forced through the spaces between the inner and outer tubes. Depending on whether the unit is functioning in a cooling or a heating capacity, heat is rejected from one tube to the other.

Liquid Line Filter Drier
The liquid line filter drier prevents moisture and foreign matter from entering the thermal expansion valve. It is located in the compressor compartment.

Hot Gas Bypass Valve
On units equipped with hot bypass, hot gas from the compressor is injected into the liquid line of the airside coil after the TXV. This process starts when suction gas temperatures drop below 28ºF, which is 32º–34ºF coil surface temperature. Hot gas helps the airside coil from freezing up and the compressor from cycling. The valve is factory set, but should be field adjusted to maintain a suction pressure of 90 psi.

Valve Adjustment: To adjust the valve, connect a pressure gauge to the suction line and block the entering air to the coil. The valve should begin to open when the suction pressure drops to approximately 58 PSIG (the valve will feel warm to the touch). Adjustments are made by first removing the cap on the valve and then turning the adjusting stem counterclockwise to decrease the pressure. Allow several minutes between adjustments for system to stabilize. When adjustment is complete, replace the cap on the valve.

Reversing Valve
Each compressor is equipped with a reversing valve to reverse the direction of refrigerant flow. The valve is electrically actuated.

Access Ports
For easy measurement and charging access, several ports are provided throughout the system. These can be used to measure system pressures and also charge or evacuate the system.

Heat Pump Controls

Each unit is factory provided with a Unit Protection Module (UPM) that controls compressor operation and monitors the safety controls that protect the unit. The UPM is a printed circuit board and is found in the heat pump module.

Safety controls include the following:

- High pressure switch located in the refrigerant discharge line and wired across the HPC terminals on the UPM.
- Low pressure switch located in the unit refrigerant suction line and wired across terminals LPC1 and LPC2 on the UPM.

The UPM includes the following features:

Anti-Short Cycle Timer
Five minute delay on break timer to prevent compressor short cycling.

Random Start
Each controller has a unique random start delay ranging from 270 to 300 seconds to reduce the chances of multiple units simultaneously starting after initial power up or after a power interruption, creating a large electrical spike.

Low Pressure Bypass Timer
The low pressure switch is bypassed for 120 seconds after compressor start-up to prevent nuisance low pressure lockouts during cold start-up in the heating mode. If the low pressure switch remains opened after 120 seconds, the unit enters a soft lock.

Brownout/Surge/Power Interruption Protection
The brownout protection in the UPM board will shut down the unit if the incoming power falls below 18 VAC. The unit will remain off until a minimal incoming power of 18 VAC is detected. Once proper power is restored, the unit will start-up within the random start time period.

Malfunction Output
The controller has a set of wet contacts for remote fault indication or dry contacts for communication with a DDC controller or BMS. The fault output will depend on the dip switch setting for “ALARM”. If set to “CONST”, a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to “PULSE”, a pulse signal is produced and a fault code is detected by a remote device indicating the fault. The remote device must have a malfunction detection capability when the UPM board is set to “PULSE”.

Test Dip Switch
A test dip switch is provided to reduce all time delay settings to five seconds during troubleshooting or verification of unit operation. Note that operation of the unit while in test mode can lead to accelerated wear and premature failure of the unit. The “TEST” switch must be set back to “NO” for normal operation.

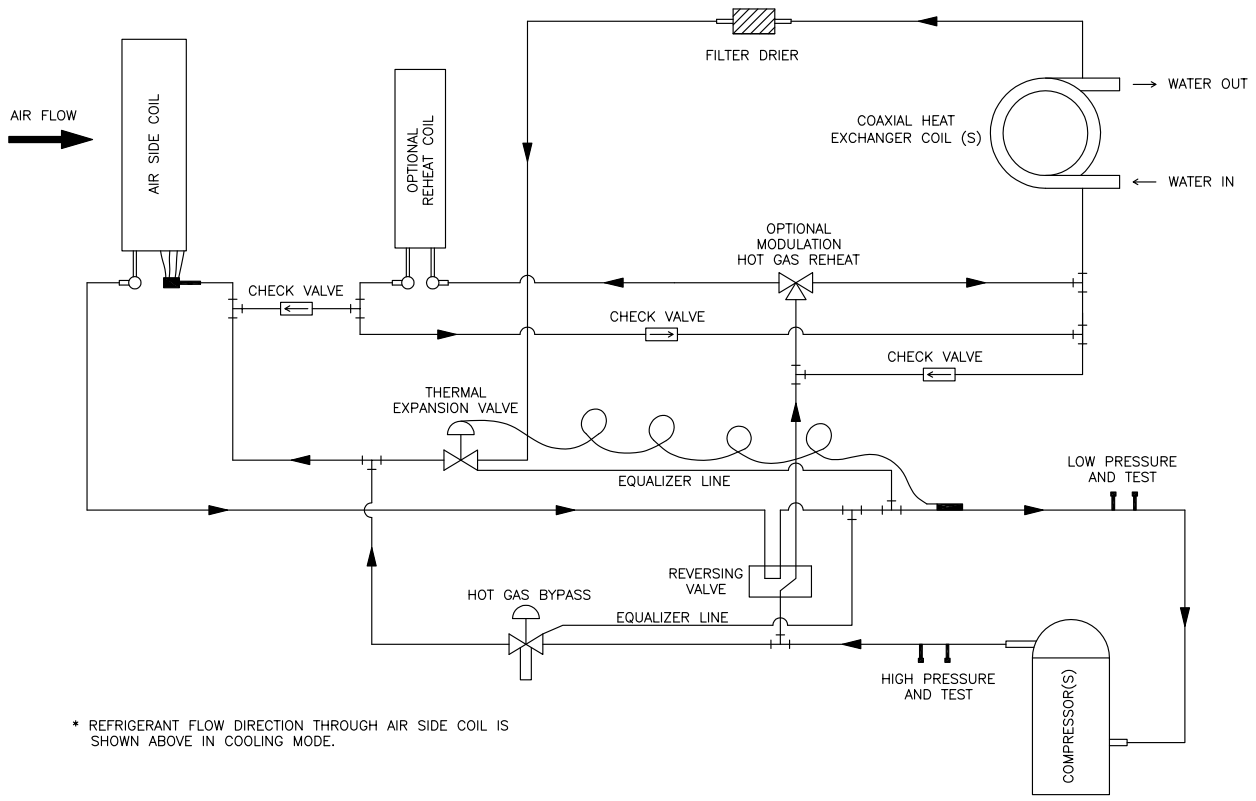
Freeze Sensor
This is optional and can be set to ignore or monitor a freeze sensor. There are two configurable freeze points, 35°F and 15°F. The unit will enter a soft lockout until the temperature climbs above the set point and the anti-short cycle time delay has expired.

NOTE

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the “Freeze” switch set to 35°F in order to shutdown the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

Crankcase Heater
A crankcase heater is installed around the base of each compressor in the unit to boil-off any liquid refrigerant that may be absorbed into the oil during idle periods. It is recommended the heater operate 24 hours prior to the compressors being started.

Refrigeration System Schematic



Typical Operating Conditions

	Location	Refrigerant State	Temperature	Pressure	Superheat/Subcool
Cooling Mode / Refrigerant Properties	Before water-to-refrigerant heat exchanger	Hot Vapor	150°F	330 PSIG	50°F Superheat
	After water-to-refrigerant heat exchanger	Warm Liquid	85°F	330 PSIG	15°F Subcool
	After Thermostatic Expansion Valve	Saturated Liquid-Vapor mix	-45°F	144 PSIG	
	After Airside Coil	Cold Vapor	55°F	145 PSIG	10°F Superheat

Water entering the coaxial heat exchanger is warmed by the heat it absorbs from the refrigerant and leaves about 10°F warmer.

	Location	Refrigerant State	Temperature	Pressure	Superheat/Subcool
Heating Mode / Refrigerant Properties	Before Airside Coil	Hot Vapor	130°F	250 PSIG	50°F Superheat
	After Airside Coil	Warm Liquid	65°F	250 PSIG	15°F Subcool
	After Thermostatic Expansion Valve	Saturated Liquid-Vapor mix	-35°F	120 PSIG	
	After water-to-refrigerant heat exchanger	Cold Vapor	45°F	120 PSIG	10°F Superheat

Water entering the coaxial heat exchanger is cooled because of the heat being absorbed by the refrigerant and leaves about 6°F warmer.

Unit Protection Module (UPM) Fault Indications

Each unit includes one Unit Protection Module (UPM) printed circuit board and each UPM has two LED indictor lights.

LED Color	LED Fault Indication		
Green	Power LED indicates 18-30 VAC present at the board		
Red	Dual or Single Compressor	# of blinks	Status
	Dual Compressor	1	High pressure lockout Compressor 1
		2	Low pressure lockout Compressor 1
		3	High pressure lockout Compressor 2
		4	Low pressure lockout Compressor 2
		5	Freeze sensor lockout (optional item)
		6	Condensate overflow in coil drain pan (optional item)
		7	Brownout AC voltage to R and C terminal below 18 VAC
	Single Compressor	1	High pressure lockout
		2	Low pressure lockout
		3	Freeze sensor lockout (optional item)
		4	Condensate overflow in coil drain pan (optional item)
		5	Brownout AC voltage to R and C terminals below 18 VAC

Intelligent Reset

If a fault condition is initiated, the five minute delay on break time period and the random start timer is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.

Lockout Reset

A hard lockout can be reset by turning the unit thermostat off and then back on when the “RESET” dip switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” dip switch is set to “R”.

Your UPM board will come from the factory with the following default settings:

Default Settings	
Freeze	NO
Temp	35°
Lockout	2
Reset	T
Alarm	CONT
Test	NO
Hot/Dry Alarm	HOT

Troubleshooting - Controller Alarms

The first step in troubleshooting the unit is to check the on-board alarm indicators. Several of the electronic controls in the unit monitor the system for faults and will go into alarm, shutting down the unit or a single function within the unit.

DDC Controller

Check the screen on the DDC for an alarm condition. If the DDC is in an alarm condition, a message will show on the DDC screen.

The DDC is located in the main control center. If the DDC is in alarm condition, the alarm button will blink red. Press the alarm button to see the specific condition or to reset the DDC. Refer to the DDC Installation Operations and Maintenance manual for detailed information on fault codes and see the unit-specific wiring diagram.

Phase Monitor

The phase monitor has two LED indicator lights, one red and one green. Green indicates proper operational status, red indicates the unit has detected a fault and is in alarm condition.

Variable Frequency Drive (VFD)

Variable frequency drives have a display screen that will show an alarm condition. If a fault such as a voltage spike occurs, the VFD will go into alarm and will not reset until a hard restart is performed. See the unit-specific manufacturer's manual supplied with the unit. VFDs are located in the main control center.

FX05 Furnace Controller

Present only if an indirect gas-fired furnace option is present.

The FX05 furnace controller will display an alarm condition if present. The controller will be found in the furnace control cneter. See the furnace installation, operation and maintenance manual and the controller manufacturer's unit-specific manul for further information.

Troubleshooting – Airflow

The **Test and Balance Report** (TAB) is utilized to determine whether the appropriate amount of outdoor air and exhaust air is being supplied and removed from a building, respectively. There are no set rules on what information must be included in a TAB report. As such, if a TAB report indicates that the airflow on a unit is low, prior to contacting the factory, please determine the following information:

	Unit #1	Unit #2	Unit #3	Unit #4
Model Number				
Serial Number				
Nameplate Information				
Voltage				
Hertz				
Phase				
Outdoor Air Fan Amps				
Outdoor Air Fan Horsepower				
Design Airflow				
Outdoor Air				
Measured Airflow				
Outdoor Air				
Measured Data				
Blower Rotation				
Outdoor Air Fan RPM				
Outdoor Air Fan Amp Draw				

Airflow problems can often be tied back to improper ductwork installation. Be sure to install ductwork in accordance with SMACNA and AMCA guidelines.

Troubleshooting – Unit

Symptom	Possible Cause	Corrective Action
Blower fails to operate	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker and check amps.
	Defective motor or capacitor.	Replace.
	Motor starter overloaded.	Reset starter and check amps.
	Electrical.	Check for On/Off switches. Check for correct supply voltage.
	Drive.	Check for broken or loose belts. Tighten loose pulleys.
Motor starters "chatter" or do not pull in	Control power (24 VAC) wiring run is too long (resistance should not exceed 0.75 ohms).	Shorten wiring run to mechanical room or install a relay which will turn unit on/off. Consult Factory for relay information. Increase wire gauge size so that resistance is .075 ohms or less.
	Incoming supply power is less than anticipated. Voltage supplied to starter coil must be within +10% / -15% of nominal voltage stated on the coil.	Need to increase supply power or use a special control transformer which is sized for the actual supply power.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Unit

Symptom	Possible Cause	Corrective Action
Motor over amps	CFM too high.	Check cfm and adjust drives if needed.
	Static pressures are higher or lower than design.	If higher, ductwork should be improved. If lower, fan rpm should be lower.
	Blower rotation is incorrect.	Check rotation and reverse if necessary.
	Motor voltage incorrect.	Check motor nameplate versus supplied voltage.
	Motor horsepower too low.	See specifications and catalog for fan curves to determine if horsepower is sufficient.
	Shorted windings in motor.	Replace motor.
Low airflow (cfm)	Unit damper not fully open.	Adjust damper linkage or replace damper motor.
	System static pressure too high.	Improve ductwork to eliminate losses using good duct practices.
	Blower speed too low.	Check for correct drives and rpm with catalog data.
	Fan wheels are operating backwards.	For 3-phase, direction can be reversed by interchanging any two of the three electrical leads.
	Dirty filter.	Follow cleaning procedures in Routine Maintenance section.
	Leaks in ductwork.	Repair.
	Elbows or other obstructions may be obstructing fan outlet.	Correct or improve ductwork.
	Belt slippage.	Adjust belt tension.
High airflow (cfm)	Blower fan speed too high.	Check for correct fan rpm. Decrease fan speed if necessary.
	Filter(s) not in place.	Install filters.
	Insufficient static pressure (Ps) (airflow resistance).	Induce Ps into system ductwork. Make sure grilles and access doors are installed. Decrease fan speed if necessary.
Excessive noise or vibration	Fan wheel rubbing on inlet.	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	Bearings.	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel out of balance.	Replace or rebalance.
	Loose wheel on shaft.	Tighten wheel setscrew.
	Loose motor or blower sheave.	Tighten sheave setscrew.
	Belts too loose.	Adjust belt tension after 24 hours of operation.
	Belts too tight.	Loosen to maintain a 3/8 inch deflection per foot of span between sheaves.
	Worn belt.	Replace.
	Motor base or blower loose.	Tighten mounting bolts.
	Buildup of material on wheel.	Clean wheel and housing.
	Bearing and drive misaligned.	Realign.
	Noise being transmitted by duct.	Make sure ductwork is supported properly. Make sure ductwork metal thickness is sized for proper stiffness. Check duct size at discharge to ensure that air velocities are not too high.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

TROUBLESHOOTING NOTE

Before any components are changed on the refrigeration system, the cause of the failure must be identified. Further problems will exist unless the true cause or problem is identified and corrected.

IMPORTANT

Do not release refrigerant to the atmosphere! If required service procedures include the adding or removing of refrigerant, the service technician must comply with all federal, state and local laws. The procedures discussed in this manual should only be performed by an EPA Certified Technician.

NOTE: Unit is equipped with a phase loss/phase reversal control. If system does not start, check phase of electrical supply.

Symptom	Possible Cause	Corrective Action
Compressor will not run or does not try to start	Open disconnect switch or circuit breaker.	Close switch and / or breaker.
	Compressor contactor not closing.	Check voltage to contactor coil, transformer, slave relay, system. Replace parts as necessary.
	Blown fuse or tripped breaker.	Check for reason and repair. Replace fuse after correcting problem.
	Low line voltage.	Check line voltage. If more than 10% from compressor marking, correcting is necessary.
	Compressor motor protector open.	Motor thermal protector automatically resets. Allow time (2 hrs.) for compressor to cool down so protector will reset. Restart and check for reason overheat occurred.
	Compressor defective.	Check motor for open circuit, short circuit, grounded windings or burn out. Compressor may be seized; check refrigerant. If necessary, replace compressor.
	High or low pressure switch open or defective.	If manual reset (high pressure), reset switch. (Switch opens at 600 psi and will not reset above 420 psi for R-410A. If auto reset (low pressure) does not reset and everything else is OK, replace switch.
	Open room thermostat or control (no cooling required).	Check room temperature. If temperature is proper, wait for thermostat to close.
	Loose wiring.	Check all wire terminals and tighten as necessary.
Compressor starts but cuts out on low pressure	Low refrigerant charge.	Check refrigerant pressures.
	Airflow restricted.	Check for dirty evaporator coil, dirty filters, dampers closed, iced evaporator coil, improper belt, check motor amps, check duct design.
Low pressure switch activates at 50 PSIG for R-410A	Restriction in refrigerant line.	Check refrigerant pressure, check and adjust thermal expansion valve. If not functioning properly, check for pressure drop across the filter drier.
	Defective low pressure switch.	Replace.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Compressor starts but cuts out on high pressure switch High pressure activates at 600 PSIG for R410A	Refrigerant overcharge.	Check pressures, charge by subcooling.
	Condenser fan motor defective.	Check fan motor.
	Condenser coil inlet obstructed or dirty.	Check coil and inlet clearances.
	Air or non-condensables in system.	Check high side equalized pressure reading with equivalent outdoor temperature.
	Defective high pressure switch.	Replace.
	Restriction in discharge or liquid line.	Check refrigerant line pressures, check thermal expansion valves.
	Condensing fan relay not pulling in.	Replace.
	Reheat valve and bypass valve not opening.	Check valves or valve circuit board.
Compressor cuts out on thermal overload	Low voltage.	Check voltage.
	Sustained high discharge pressure.	Check running amperage and conditions described under ‘Low suction pressure’ symptoms.
	High suction and discharge pressures.	Check thermal expansion valve setting, check for air in system.
	Defective compressor overload.	If compressor is hot, allow compressor to cool for two hours. Recheck for open circuit.
	Improper refrigerant charge.	Check subcooling.
	Improperly wired.	Review wiring schematics.
	Loose wiring.	Check all connections and wires.
	Defective start relay.	Replace relay.
	Motor windings damaged.	Verify amp draw.
Compressor hums, but will not start	Improperly wired.	Review wiring schematics.
	Low line voltage.	Check voltage.
	Loose wiring.	Check all connections.
	Defective start or run capacitor.	Check run capacitor for compressor and fan motor.
	Defective relay start.	Replace relay.
	Motor winding damaged.	Verify amp draws.
	Internal compressor mechanical damage.	Replace.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Compressor noisy or vibrating	Refrigerant overcharge.	Check pressures and subcooling.
	Liquid floodback.	Check thermal expansion valve setting. Check for refrigerant overcharge.
	Tubing rattle.	Dampen tubing vibration by taping or clamping. Carefully bend tubing away from contact where possible.
	Scroll compressor rotating in reverse (3 phase).	Rewire for opposite rotation.
	Worn or damaged compressor.	Replace the compressor.
	Improper mounting on unit base.	Check that compressor is properly isolated.
High suction pressure	Excessive load on evaporator coil.	Check for high entering wet bulb temperature. Check for excessive air.
	Compressor is unloaded.	Check head pressure, check thermal expansion valve if not functioning properly, check pressure drop across filter drier.
	Expansion valve not secured to suction line.	Check the thermal expansion valve, ensure bulb is insulated. Check superheat. If superheat is high, then valve is out of control and pegged wide open. • Check bulb for contact. • Adjust valve for superheat. • Replace valve powerhead or valve.
	Thermostatic expansion valve pressure limit feature incorrect or inoperative. Overfeeding.	Check bulb location and clamping. Adjust superheat. Replace expansion valve power head.
	Room load too large.	Reduce the load or add more equipment.
	Overcharged.	Check pressures and subcooling.
High discharge pressure	Thermal expansion valve setting.	Check thermal expansion setting and calibrate superheat.
	Air inlet to condenser dirty or obstructed.	Check for proper clearances and possible air recirculating.
	Condenser fan motor defective.	Check condenser fan motor.
	Too much refrigerant.	Remove excess refrigerant.
	Non-condensable in system.	Remove non-condensable from system.
	Dirty condenser coil.	Clean condenser coil.
	Condenser fan not running or running backwards.	Check electrical circuit and fuse. Check fan cycling controls.
	Discharge service valve partially closed.	Open valve.
	High load conditions.	Add more equipment or reduce load.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Low suction pressure	Refrigerant undercharge.	Check pressures and subcooling.
	Blower running backward.	Interchange any two wires from 3 phase disconnect.
	Loose blower, pulley or belts.	Check drive pulley alignment, belt tension.
	Low entering air temperature (low load condition).	Check entering air wet bulb conditions.
	Refrigerant leak.	Check system for leaks. Repair leaks and add refrigerant.
	Evaporator dirty or iced up or airflow restricted.	Check defrost system. Clean the coil. Check fan operation. Check airflow.
	Plugged liquid line filter-drier.	Replace filter-drier.
	Improper suction pressure regulator setting.	Check setting and correct as required.
	Expansion valve defective, superheat too high, or valve too small.	Adjust valve for proper superheat or replace the expansion valve if too small or defective.
	Moisture in system.	Reclaim refrigerant, check for leaks, recharge.
Low discharge pressure	Insufficient refrigerant charge.	Check subcooling, check for leak. Repair leak and add refrigerant.
	Defective or improperly adjusted expansion valve.	Check superheating and adjust thermal expansion valve.
	Low suction pressure.	See “Low suction pressure”.
	Faulty condenser temperature controls.	Check condenser controls and reset to obtain desired condensing temperature.
Compressor short cycles	Thermostat location or malfunction.	Check thermostat, check heat anticipator setting.
	Improper refrigerant charge.	Check subcooling, verify superheat.
	Defective high or low pressure control.	Check high or low pressure switch.
	Liquid floodback.	Possible tight bearings.
	Defective expansion valve.	Check thermal expansion valve and superheat.
	Poor air distribution.	Check ductwork for recirculating.
	High discharge pressure.	See “High discharge pressure”.
	Leaking discharge valves in compressor.	See “High suction pressure”.
	Low airflow at evaporator(s).	Check blower operation and airstream restrictions.
	Incorrect unit selection (oversized).	Contact factory.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Low or no oil pressure	Low oil level (trapped oil in evaporator or suction line).	Thoroughly defrost evaporator. After defrost, observe level, add oil. Check for leaks. Check lines for proper slope and traps.
	Excessive liquid refrigerant in the crankcase.	Adjust expansion valve for higher superheat. Check crankcase heater.
	Worn oil pump.	Replace the oil pump.
	Worn compressor bearings.	Replace the compressor.
	Loose fitting on oil line or pump housing gasket leaking.	Check and tighten system. Check bottom plate or compressor.
	Compressor short cycling.	Check low pressure control setting.
Compressor loses oil	Refrigerant leak.	Check system for leaks. Repair leaks and add refrigerant.
	Short cycling.	Check low pressure control settings.
	Refrigerant flood back.	Check thermal expansion valve setting. Check for refrigerant overcharge.
	Improper piping or traps.	Verify proper piping slopes.
	Reheat flush cycle inadequate.	Contact factory.
Running cycle is too long or unit operates continuously	Refrigeration undercharged.	Check subcooling.
	Dirty filter or evaporator coil.	Check filter, coil and airflow.
	Dirty or clogged condenser coil.	Check coil and airflow.
	Air or other non-condensables in system.	Check equalized high side pressure with equivalent outdoor temperature.
	Defective compressor.	See “High suction pressure”.
	Restriction in suction and liquid line.	Check for restrictions in refrigerant circuit.
	Control contacts stuck.	Check wiring.
	Excessive load.	Add more equipment or reduce room load.
	Too low of a system thermostat setting or defective thermostat.	Adjust or replace thermostat.
Liquid line is too hot	Refrigerant undercharge.	Adjust the charge by subcooling.
	High discharge pressure.	See “High discharge pressure”.
Liquid line is frosted or wet	Restriction in liquid line.	Clear restriction upstream of point of frosting.
Suction line is frosting	Insufficient evaporator airflow.	Check airflow, check filters, check drive for loose parts or belts.
	Restriction in suction or liquid line.	Restriction upstream of point of frosting.
	Malfunctioning or defective expansion valve.	Check bulb of thermal expansion valve.
Frost on evaporator coil	Hot gas bypass valve not functioning properly.	Check valve. If defective, replace.
	Manual hot gas bypass valve closed.	Open valve.

Always have a completed Pre Start-Up Checklist and Unit Start-Up Checklist prior to requesting parts or service information.

Routine Maintenance

DANGER

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

CAUTION

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

This unit requires minimal maintenance to operate properly. To ensure proper operation and longevity, the following items should be completed. The items in this list assume a relatively clean air environment, and may require attention more frequently in a dirty or dusty area. If this unit contains an indirect gas heater, refer to the Installation, Operation and Maintenance Manual provided with the unit for maintenance purposes. A Certified Technician should complete all refrigerant systems checks.

Maintenance Frequency:

Monthly

1. External Filter
   Check for cleanliness – clean if required
2. Internal Filter
   Check for cleanliness – replace if required
3. Condensate Drain (if applicable)
   Inspect and clean – refill with water
4. Bearings
   Lubricate per the schedule in the Fan Bearings section

Semiannually

1. Fan Belts
   Check for wear, tension, alignment
2. Check for belt wear
   Check pulley, bearings, and motor
3. Bearings
   Lubricate per the schedule in the Fan Bearings section

Annually

It is recommended that the annual inspection and maintenance occur at the start of the cooling season. After completing the checklist, follow the unit start-up checklist provided in the manual to ensure the refrigeration system operates in the intended matter.

1. Lubrication
   Apply lubrication where required
2. Dampers
   Check for unobstructed operation
3. Motors
   Check for cleanliness
4. Fan Belts
   Check for wear, tension, alignment
5. Blower Wheel & Fasteners
   Check for cleanliness
   Check all fasteners for tightness
   Check for fatigue, corrosion, wear
6. Bearings
   Lubricate per the schedule in the Fan Bearings section
7. Door Seal
   Check if intact and pliable
8. Wiring Connections
   Check all connections for tightness
9. Inspect all coils for cleanliness. Clean if required.
10. Inspect exterior and interior of entire unit for surface rust. If rust is found, remove rust and coat the blemished area with an appropriate protectant.

Heat Pump

An annual inspection of the heat pump system by a licensed refrigeration mechanic is recommended.

1. Inspect entire heat pump for cleanliness.
2. Record performance data for volts, amps and water temperature differences (both heating and cooling).
3. Compare annual data to recorded start-up data.

Maintenance Procedures:

Lubrication

Check all moving components for proper lubrication. Apply lubrication where required. Any components showing excessive wear should be replaced to maintain the integrity of the unit and ensure proper operation.

Dampers

Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely. Apply power to motorized dampers to ensure the actuator opens and closes the damper as designed.

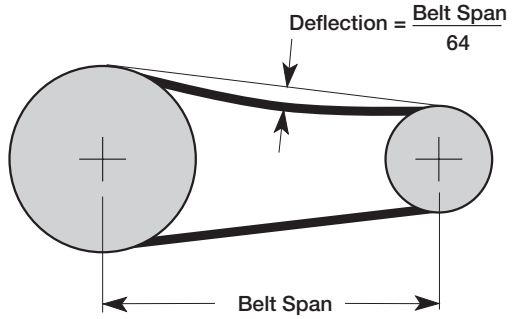
Fan Belts

Belts must be checked on a regular basis for wear, tension, alignment, and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage, and overheated sheaves. Both loose and tight belts can cause fan vibration.

When replacing belts on multiple groove drives, all belts should be changed to provide uniform drive loading. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, insure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

The proper belt setting is the lowest tension at which the belts will not slip under peak load operation. For initial tensioning, set the belt deflection at 1/64-inch for each inch of belt span (measured half-way between sheave centers). For example, if the belt span is 64 inches, the belt deflection should be 1 inch (using moderate thumb pressure at mid-point of the drive). Check belt tension two times during the first 24 hours of operation and periodically thereafter.



Fan Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Never wash-down motor with high pressure spray. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication.

Fan Wheel and Fasteners

Wheels require very little attention when moving clean air. Occasionally oil and dust may accumulate on the wheel causing imbalance. When this occurs the wheel and housing should be cleaned to assure smooth and safe operation. Inspect fan impeller and housing for fatigue, corrosion or wear.

Routinely check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness. A proper maintenance program will help preserve the performance and reliability designed into the fan.

Fan Bearings

Most bearings are permanently lubricated and require no further lubrication under normal use. Normal use being considered -20ºF to 120ºF and in a relatively clean environment. Some bearings are relubricatable and will need to be regreased depending on fan use. Check your bearings for grease zerk fittings to find out what type of bearing you have. If your fan is not being operated under normal use, bearings should be checked monthly for lubrication. Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. Refer to the recommended bearing lubrication schedule:

Bearing Lubrication Schedule for Plenum Fans (Relubrication Schedule in Months)

Fan RPM	Shaft Diameter in Inches			
	½ to 1	1⅛ to 1½	1⅝ to 1⅞	11⁵⁄₁₆ to 2³⁄₁₆
To 250	6	6	6	6
500	6	6	6	5
750	6	5	4	3
1000	6	4	3	2
1250	5	3	2	1
1500	5	2	1	1
2000	5	1	1	.5
2500	4	.5	.5	.25
3000	4	.5	.25	.25
4000	3	.25	.25	.25
5000	2	.25	.25	.25

If unusual conditions exist—temperatures below 32ºF or above 200ºF, moisture or contaminants—more frequent lubrication is required.

With the unit running, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal.

Be careful not to unseat the seal by over lubricating or using excessive pressure. A guide to the amount of grease to be used is to fill 30% to 60% of available space in the bearing and housing.

A high quality lithium based grease conforming to NLGI Grade 2 consistency, such as those listed below should be used:

Mobil 532	Texaco Premium #2	B Shell Alvania #2
Mobilux #2	Texaco Multifak #2	Unirex 2

In addition to lubricating the bearings at specified intervals, set screws in the bearing collars should be checked for tightness. A bearing collar which has loosened will cause premature failure of the fan shaft. Fasteners attaching the bearings to the drive frame should also be checked.

Internal Filter Maintenance

The unit will typically be provided with 2-inch, pleated filters in the supply airstream. These filters should be checked per a routine maintenance schedule and replaced as necessary to ensure proper airflow through the unit. Replacement filters shall be of same performance and quality as factory installed filters. Filter type must be pleated design with integral metal grid. Two acceptable filter replacements are Aerostat Series 400 or Farr 30/30®.

Outdoor Air Filters: Access to the outdoor air filters is through the door labeled as "Filter Access" on the access side of the unit.

Refer to Subassemblies/Filters section for additional information on filter locations.

WARNING

REFER TO GENERAL SAFETY INFORMATION

Do not operate make-up air ventilator without the filters and birdscreens installed. They prevent the entry of foreign objects such as leaves, birds, etc.

Do not remove access panels or other unit components while standing on a ladder or other unsteady base. Access panels and unit components are heavy and serious injury may occur.

External Filter Maintenance

Aluminum mesh, 2-inch deep filters are located in the supply weatherhood (if the weatherhood option was purchased). Filters should be checked and cleaned on a regular basis for best efficiency. The frequency of cleaning depends upon the cleanliness of the incoming air. These filters should be cleaned by rinsing with a mild detergent in warm water prior to start-up.

Filters upstream of the coil should be checked regularly. If the filters are dirty, they should be cleaned or replaced. It is important that the coils stay clean to maintain desired airflow.

Coil Maintenance

Coils must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and if dirty, brush or vacuum clean. Soiled fins reduce the capacity of the coil, demand more energy from the fan, and create an environment for odor and bacteria to grow and spread through the conditioned zone. High pressure water (700 psi or less) may be used to clean coils with fin thickness over 0.0095 inches thick. **TEST THE SPRAY PRESSURE** over a small corner of the coil to determine if the fins will withstand the spray pressure.

For coils with fragile fins or high fin density, foaming chemical sprays and washes are available. Many coil cleaners contain harsh chemicals, so they must be used with caution by qualified personnel only. Care must be taken not to damage the coils, including the fins, while cleaning. **Caution: Fin edges are sharp.**

WARNING

Biological hazard. May cause disease. Cleaning should be performed by qualified personnel.

Drain pans in any air conditioning unit will have some moisture in them, therefore, algae and other organisms will grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Inspect twice a year to avoid the possibility of overflow. Also, drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

Maintenance Log

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Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the shipment date. The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of five years from the shipment date. Any units or parts which prove defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Greenheck Catalog Energy Recovery Ventilator with Integral Water Source Heat Pump, Model ERCH-HP, provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at: www.amca.org.

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Building Value in Air.

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